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Magnetoelectric spin accumulation in mesoscopic conductors[1]
PHILIPPE JACQUOD, University of Arizona — We present a calculation of the electrically induced spin accumulation in mesoscopic systems in presence of both Rashba (with strength α) and Dresselhaus (with strength β)spin-orbit interactions. For diffusive systems, we follow a diffusion equation approach to show that magnetoelectric effects disappear and that there is thus no spin accumulation when $\alpha = \pm\beta$. We show however that the singularity is broadened and that the suppression of spin accumulation becomes physically relevant (i) in finite-sized systems, (ii) in the presence of a cubic Dresselhaus interaction, or (iii) for finite frequency measurements. For ballistic systems, we present a novel scattering approach to (global) spin accumulation where charge and spin-dependent chemical potentials are extracted by an external probe. In this way the total spin accumulation, including its average and mesoscopic fluctuations, as well as its correlations with spin currents can be calculated from the statistics of transmission probabilities. I will present such a calculation based on both random matrix theory and the trajectory-based semiclassical approach.

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Philippe Jacquod
University of Arizona

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